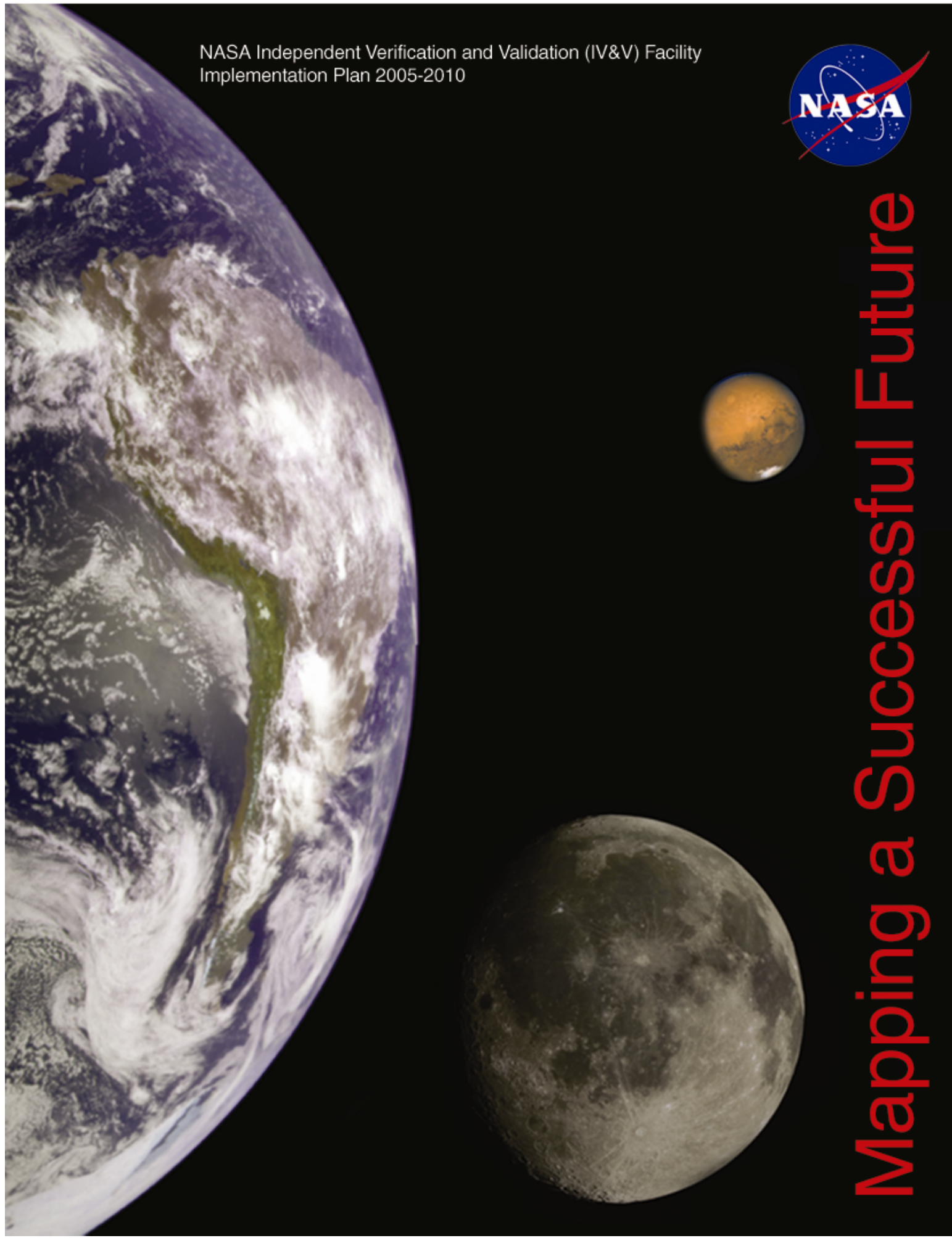


NASA Independent Verification and Validation (IV&V) Facility
Implementation Plan 2005-2010



Mapping a Successful Future



Letter from the Director

NASA IV&V's Implementation Plan 2005-2010, *Mapping a Successful Future*, represents the results of our commitment to comprehensive planning as a cornerstone of how we effectively operate and succeed in today's ever-changing world. Through sound planning and execution of our Implementation Plan, we directly contribute to advancing NASA's work.

Framed within a three-pillar concept, this plan addresses the areas: IV&V Services, Research and Outreach. As part of our planning process, we confirmed the earlier established shared vision to guide us and updated the encompassing mission that clearly delineates what we do. Also very important to our successful future are the guiding values NASA IV&V embraces and that map directly to the core values NASA has stated. We are pleased too, that our plan aligns with the ONE NASA Strategic Plan and fully supports the Goddard Space Flight Center Implementation Plan.

Based on listening to many different voices from different perspectives both within the NASA IV&V organization and from external customers and stakeholders, a set of overarching goals drive our priority actions. Our success depends on our daily work being appreciated by our customers along with the value others find in our research efforts, educational outreach, and support of our community.

The Implementation Plan clearly delineates our commitment to our customers and to our employees. Our customers are at the foundation of our work, and our employees are our most valuable assets.

I look forward to working together with all of you as we continue to turn this plan into reality.

Sincerely,



Nelson Keeler
Director, NASA IV&V Facility
Fairmont, West Virginia

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*“In broad terms, our mandate is to pioneer the future . . .
to push the envelope . . . to do what has never been done before.
An amazing charter indeed . . . NASA is what Americans . . .
and the people of the world . . . think of when the conversation
turns to the future.”*

—Sean O’Keefe, former NASA Administrator

The Planning Process

Background

NASA Independent Verification and Validation (IV&V) continues to establish an increased value-added presence within the NASA community and beyond. These efforts center around NASA IV&V's main purpose to provide software services (e.g., independent verification and validation of the critical software under development, independent assessments of software development practices and products, systems engineering support, and software assurance research). The NASA IV&V organization continues to grow and become stronger as it contributes to a wide variety of NASA missions and projects.

The NASA IV&V Facility in Fairmont, West Virginia, was established in 1993 as part of an agency-wide strategy to provide the highest achievable level of safety and cost effectiveness for NASA's mission-critical software. The Facility became part of the Goddard Space Flight Center (GSFC) in July 2000. Since becoming a part of GSFC, the NASA IV&V organization has completed an initial Business Plan, a subsequent Program Plan, and an NPD 8730.4 policy document. These three documents provided, in part, the foundation for the planning process and results.

Regarding setting direction and overall development, a number of initiatives were undertaken from 2001 to 2004 that improved the organization. These included organizational development work, enhancing customer focus, improving performance measurement, and strengthening staff capacity. In addition, significant time has been spent on formal planning that engaged the entire organization.

Strategic planning has long been a value embraced and practiced by NASA; therefore, the NASA IV&V organization has made planning a critical element of its work.

Planning Initiatives

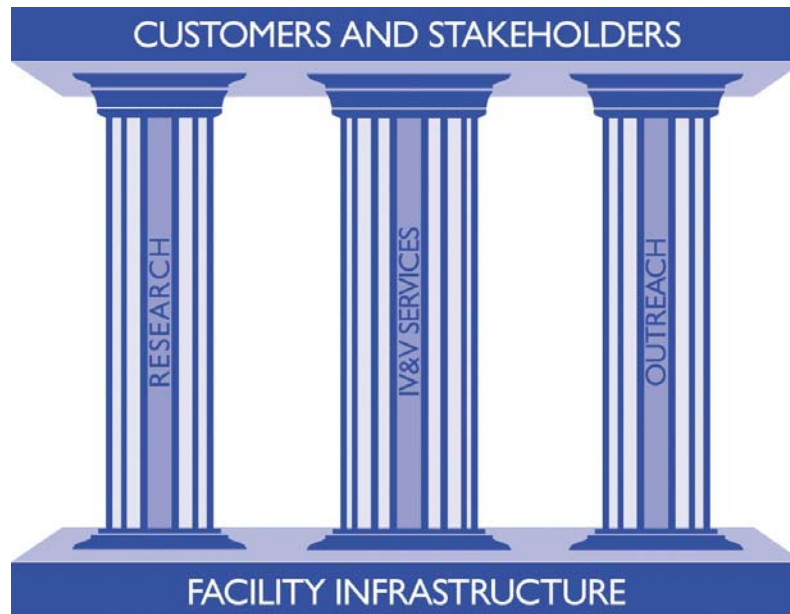
The initial NASA IV&V planning work for this Implementation Plan began in late 2001 under the then newly appointed director, Nelson Keeler. The implementation planning was part of initiatives Director Keeler started to enhance customer focus and better develop the organization. Through internal and external assessments, along with specific planning sessions, the Facility completed the first *Mapping a Successful Future* plan that was implemented at the start of 2003. As part of an on-going planning cycle, the Implementation Plan has been reviewed on an annual basis with appropriate updates made each year.

At the end of 2004 and beginning of 2005, the Implementation Plan was reviewed in more detail and updated to reflect changes in how NASA IV&V did business and to accommodate emerging requirements that surfaced during the planning review. This year's plan update integrates some changes, primarily in the objectives and strategies, as a result of the assessments completed by the planning team. In addition, the work of the Transition Plan undertaken in 2003-2004 is reflected somewhat in this plan.

Appendix A provides additional specifics regarding the planning review and update initiative.

Understanding the NASA IV&V Mission Pillars

For the NASA IV&V Facility to carry out its mission, it must execute successfully on several fronts. Understanding the key elements of its mission helps guide staff and others to advance NASA IV&V across the primary areas of focus. The diagram below offers a pictorial perspective of how NASA IV&V sees the interplay between its key elements (the pillars) and mission fulfillment.



The three primary ‘pillars’ provide the backbone to the fulfillment of our mission. These are IV&V Services, Research, and Outreach. The IV&V Services pillar holds all aspects of delivering the highest quality state-of-the-art independent verification and validation services to our customers and is the major reason for the IV&V program and Facility’s existence. The research pillar represents the myriad of research efforts undertaken to improve and advance software assurance methods, practices, and tools. The third pillar stands as a solid commitment to participate in the vitality of the community we serve through outreach in a number of proactive ways from education to economic development. This pillar also calls for us to effectively engage the public in the experience and benefit of exploration and discovery.

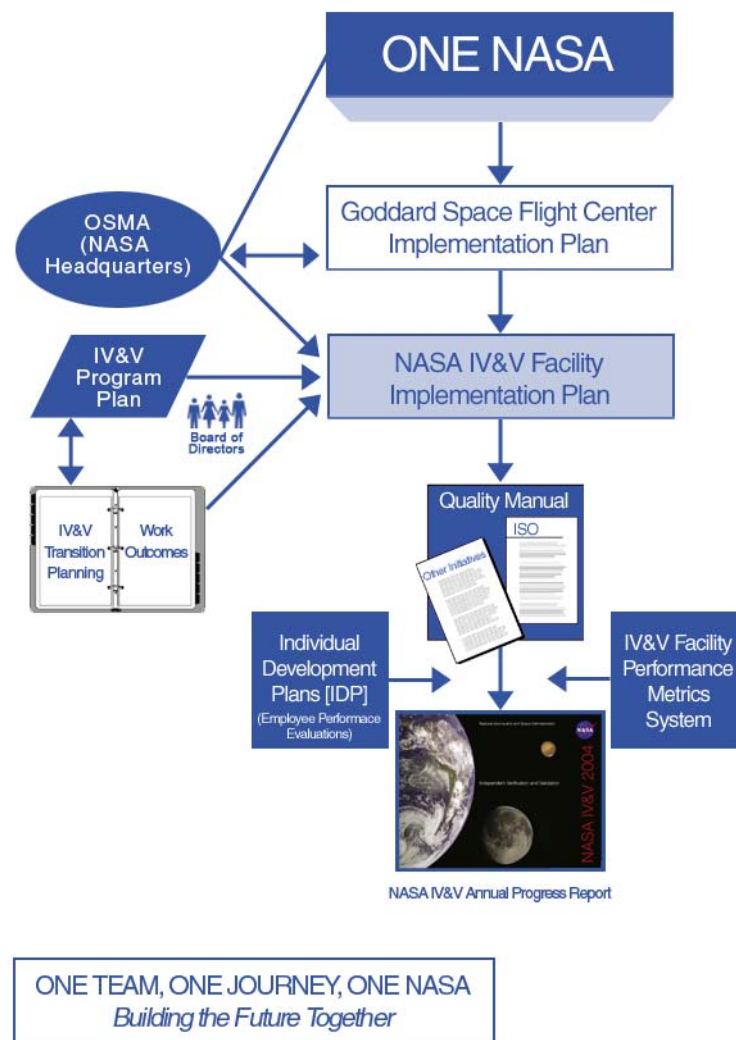
As clearly depicted in the diagram, customers and stakeholders are at the top and are supported in all the activities undertaken in each of the three pillars.

The ultimate success of the three pillars rests with the ability to effectively and efficiently fulfill our mission every day within an environment that fosters work activities and removes unnecessary barriers to effective working conditions. Thus, the diagram indicates an underlying facility infrastructure that supports all pillars. This infrastructure is comprised of administration, operations, and maintenance through facility management, and management systems. Through the provision of an effective and efficient infrastructure, the work within the pillars will be successful.

Planning Alignment & Update

NASA has stated its vision to be: “To improve life here, To extend life to there, To find life beyond.” Part of the strategic and organizational planning done by NASA been driven through the ONE NASA initiative. This activity provides the Agency’s overarching framework for direction, expectations, high-level goals, and ultimately strategies that focus all of NASA. ONE NASA challenges both the tasks to be completed, as well as, how the entire agency must work together to reach the success envisioned. From the encompassing ONE NASA initiative to the IV&V reports on progress, there is clearly an alignment of planning and organization. The intent is to garner the synergies of integration within the Facility and across entities within NASA. Diagram 1 below reflects how some of the planning and other activities are interrelated. (Note: As part of the 2004-2005 planning work, the IV&V Implementation Plan was reviewed and updated to ensure alignment with other NASA planning initiatives.)

Diagram 1
Forging an Integrated Approach in Planning, Processes, and Operations
National Aeronautics and Space Administration



Vision, Mission, and Guiding Values

NASA IV&V Facility's Vision

A vision statement defines what an organization desires to be. The vision represents the ultimate goal that an organization sets its sights on, even though it may not yet be able to fully meet the goal. The following vision captures the focus that the NASA IV&V organization has for its future.

Vision

Be acknowledged as the preeminent organization applying and improving independent verification and validation for software and systems.

NASA IV&V Facility's Mission

The mission statement defines the day-to-day purpose of the organization and the steps it takes to reach its vision. The NASA IV&V mission is rooted in the purpose of our facility, its programs, and its services. The following is the mission for the NASA IV&V organization.

Mission

NASA IV&V provides assurance for our customers' safety and mission critical software in the areas of safety, reliability and availability; performs leading-edge research that improves IV&V and software assurance methods, practices, and tools; participates in the vitality of the community, as well as engages the public in the experience and benefits of exploration and discovery.

The NASA IV&V Facility further defines its mission as the following:

1. Acquiring, developing, and promulgating the very best in independent verification and validation processes, tools, and techniques;
2. Initiating and coordinating software assurance and IV&V domain research that improves methods and practices and advances learning;
3. Seeking and embracing collaborative opportunities that garner new ideas, create positive change, and achieve success for all partners;
4. Sharing and transferring our research, knowledge, and practices with education, government, business and industry, as appropriate;
5. Supporting and developing the use of quality standards and performance metrics;
6. Participating actively in the educational, cultural, and economic vitality of the community in which our employees live and work;
7. Encouraging the development of our personnel and providing them a safe, efficient, and effective environment in which to work;
8. Pursuing continuous process improvement and second-to-none customer service; and
9. Cultivating an environment that promotes continual learning and enhances the capabilities of our organization.

NASA IV&V Facility's Guiding Values

Values—what the organization believes in—are the behaviors or characteristics that are held in high regard in all that is done both within and outside the NASA IV&V organization. These attributes are essential to maintaining and supporting the culture of an organization.

NASA has embraced four central values for the entire organization: Safety, The NASA Family, Excellence, and Integrity. During development of the Implementation Plan, seven values deemed vital to the NASA IV&V Facility's success were established. As shown in the small table below, these values align and support NASA's values. The demonstrated practice of this specific set of values will ensure their acceptance throughout the Facility.

NASA Values	Focus Values at NASA IV&V
Safety	Safety
The NASA Family	Teamwork, Respect, Balance
Excellence	Excellence, Innovation
Integrity	Integrity

Below are the shared values that the NASA IV&V organization believes in and holds in high regard. The organization embraces these in our words and deeds as it collectively shapes behaviors, pilots actions, delivers services to customers, and establishes the organization's culture.

Safety

Being safe and ensuring personal safety for employees and the public; providing security for everyone and protection of our resources and assets; being good stewards.

Teamwork

Working together; supporting each other; collaborating effectively; sharing accomplishments and successes; providing collective wisdom; being responsible; helping others; leveraging synergy; exhibiting open communication.

Respect

Noticing individual worth; being open-minded; accepting diversity; seeking first to understand and then to be understood; having credibility; empowering oneself and others; welcoming every idea; listening; being civil.

Balance

Being well rounded with work, family, and self; balancing professional and personal time; giving to the community; practicing wellness of living; having a balanced involvement that enhances all; being there; coaching others.

Excellence

Producing quality goods and services; doing the right thing; performing second to none; practicing continuous improvement; being distinctive, creative, and committed; leading in best practices; being efficient.

Innovation

Seeking better ways or new methods to do things; being imaginative to enhance processes; staying on the leading edge; being original, agile, adaptive, and responsive to change.

Integrity

Doing what was said would be done; having trust; being honest, fair, and accountable, both personally and organizationally; having steadfast ethical conduct; living by high standards of individual behavior.

NASA IV&V Facility's Customer and Employee Commitments

During the planning process, having a strong customer focus continually surfaced as being important to all that the NASA IV&V organization does. Serving the customer is a central purpose for the NASA IV&V organization. As such, a credo or statement of commitment to all customers was forged to visibly reflect this to all.

Commitment to Our Customers

Our customers are first and foremost in all we do. For every customer we work with, regardless of the purpose or the length of time, we pledge to do what it takes to truly exceed the customer's expectations. We do this by being responsive, learning and understanding customer requirements, and doing what we promise.

Similarly, recognizing our success in meeting our customer commitment depends on the service provided by our employees. The following statement was developed to reflect our commitment to the IV&V organizational employees.

Commitment to Our Employees

Our employees are the foundation of our success and our greatest resource. We value each employee and are committed to providing a safe, comfortable, well-equipped workplace while being conducive to creativity, learning, and productivity. Through our guiding principles, we will appreciate our diversity, respect each other, and focus on ensuring a balance between professional and personal time.

NASA IV& V Overarching Goals

The NASA IV&V organization's planning process brought to light many areas on which to focus in order to sustain what is good, change current practices not valued or working well, and create new opportunities. Furthermore, appropriately tapping new opportunities to help the organization fulfill its mission and reach its vision was paramount.

The specific results of the planning work range from small detailed process improvements to broader, more global thinking about what the IV&V organization should be doing in the future. In the end, the results led to nine major 'overarching' goals that are to serve as the action-planning focal points. These are presented, without priority, in the box below. Although some goals will require greater attention and more strategies, each is important and needs to be integral to the NASA IV&V Facility's planning work. Later sections of this document delineate specific objectives and strategies to help achieve each of these goals. Appendix A provides specifics as to how NASA IV&V established these goals and the resulting strategies from themes found in the assessments and planning team work. (Note: The review completed in February 2005 resulted in an update to the objectives and strategies, but only small wording changes to the original overarching goals.)

Overarching Goals 2005-2010

- A. Deliver and institutionalize high quality IV&V services throughout NASA.
- B. Be acknowledged as the preeminent leader in IV&V expertise, tools, and processes.
- C. Be internationally acknowledged for leading and conducting research that directly contributes to higher software assurance and improved IV&V practices.
- D. Establish an organizational culture that engages and rewards employees and cultivates their loyalty and commitment to the NASA IV&V organization.
- E. Ensure a continued focus on external and internal customer service that is second to none.
- F. Practice continued quality improvement, compliance and innovation throughout the NASA IV&V Facility.
- G. Advance the NASA IV&V Facility's IV&V vision and mission by managing the use of existing resources, collaborating with others and planning future growth.
- H. Be an active community partner through outreach, educational activities, and proactive service.
- I. Ensure a safe, comfortable, and well-equipped workplace that is conducive to high performance and supports individual and team productivity.

Objectives and Strategies within Goals

Within each major goal, specific objectives are defined. For every objective, one or more strategies are developed that will lead to reaching the objective and ultimately addressing the targeted goal. The majority of strategies address issues that were found in the internal and external assessment process. Some strategies may address more than one goal; however, in those instances where a specific strategy could be placed under more than one goal, it has been listed only once and placed under the goal where it most fits.

For each strategy, specific actions will be developed and implemented as the plan is executed. Actions can be immediate or extend over the period of the planning. NASA IV&V will be flexible in its planning so as to incorporate, as warranted, emerging opportunities or make adjustments to address changing external conditions that relate to carrying out its mission or fulfilling its vision.

Goal Synergy

The total goals constitute a unified direction to fulfill the NASA IV&V mission and ultimately reach its vision. Although separated into nine separate goals for specificity and to provide a logical framework for implementation, the goals are intricately linked together. Many strategies and a significant number of the actions cross goal areas and when implemented will serve more than one goal.

In some cases, the linkage of a goal to one or more other goals takes on more of a cause and effect relationship. For example, Goal A, B and C directly support IV&V work. Goal C includes development of theories, generation and solicitation of new ideas, proof of concept studies, and studies that investigate the validity of various theories within the IV&V activities. Goal B is intended to keep NASA IV&V on the cutting edge by taking concepts and results of studies from the research Goal C and turning them into practical application in the form of processes or tools.

Likewise, natural work within Goal B will generate ideas and priorities that need improvement. As warranted, these are 'handed-off' to be incorporated into Goal C work. However, when an improvement is ready for routine practice within the scope of IV&V work, it leaves Goal B and comes within the purview of Goal A. Thus, Goal A makes sure that consistent best practices exist in NASA IV&V services. Goal A is always doing the best with what is available, being proactive in adopting the improvements developed by others, and providing ideas and inputs to Goals B and C regarding areas or special tools and practices that need improvement.

There is a symbiotic relationship among these three goals. Each goal must execute its strategies effectively to ensure the others will be successful. Likewise, where one goal fails to deliver, the others can be less effective, fall behind, or fail to produce the desired quality outcomes.

Other examples can be seen across all the goals. From ensuring adequate facilities to understanding customer requirements, the underpinnings of objectives and strategies within each goal are vital parts of the total fabric that holds the plan together.

Goal Diagram

All elements of NASA work together to achieve Agency goals, a real demonstration of the One NASA philosophy. The Agency goals (categorized by Mission) are listed below and intersect with the IV&V Facility's goals (categorized by the three pillars: IV&V Services, Research and Outreach). A star appears at the point where the Agency's mission and goals are directly or indirectly supported by NASA's IV&V Facility in West Virginia.



Goal A: Deliver and institutionalize high quality IV&V services throughout NASA.

Rationale and Background

Independent Verification and Validation (IV&V) is now required throughout NASA and provided as an Agency General and Administrative (G&A) Program. IV&V still has much work to do to accurately plan and execute these services across the wide range of NASA projects and Centers that we support. The goal will be reached through continued proven successes, performance measurement, real-time process improvement feedback and awareness and education activities.

IV&V activities encompass all aspects and all phases of system and software engineering and development. The civil servant personnel manage all IV&V activities and, as such, must ensure both continued technology improvement and the ambassadorship of actively educating NASA projects on the value and appropriate levels of IV&V.

Objectives

- a. IV&V is executed effectively, efficiently, and consistently planned and managed.
- b. NASA has clearly defined and standardized the application of IV&V across NASA missions.
- c. Mission project managers recognize IV&V as an integral resource for assessing overall software readiness.

Strategies

1. Ensure IV&V project managers are highly effective and efficient in the application and execution of IV&V processes, tools, and methods. (a)
2. Monitor changing technology of software development to ensure the appropriate IV&V tools, processes, and methods are in use. (a)
3. Utilize a high quality planning process that represents the needs of the Agency and the project. (a)
4. Ensure that IV&V execution achieves technical objectives while managing cost and schedule. (a)
5. Establish a consistent process for capturing and communicating lessons learned, both internally and externally. (a,c)
6. Continue to work with the IV&V Board of Directors, NASA Management and all NASA Centers to standardize and enhance the Agency approach for proactively applying IV&V. (b)
7. Develop and maintain effective relationships between IV&V and projects and Centers. (a,c)
8. Develop and maintain the best approach for educating NASA and others on IV&V (e.g., what, methods, compelling rationale). (c)

Goal B:

Be acknowledged as the preeminent leader in IV&V expertise, tools, and processes.

Rationale and Background

The NASA IV&V organization has a vision to be the preeminent leader in IV&V. This desire stems from the somewhat singular position of the NASA IV&V organization within the United States Government as the only agency level organization dedicated solely to the execution of IV&V. The NASA IV&V organization views this position as an opportunity to lead the growth, maturation and improvement of the IV&V discipline. This leadership is realized through the development of leading-edge tools, processes and approaches to performing and managing IV&V.

However, it is not enough to improve the discipline without also sharing the results of that improvement. Through this knowledge transfer, the NASA IV&V organization can extend the recognition of its work throughout the federal government and industry, while working to enhance software and systems engineering everywhere.

Objectives

- a. A culture of continuously improving the discipline of IV&V exists.
- b. IV&V knowledge and technology are routinely transferred both internally and to others outside the NASA organization.
- c. The IV&V Services organization is a respected and valued resource beyond NASA.

Strategies

1. Develop leading edge IV&V methods and tools using the best of both in-house and external knowledge and research. (a)
2. Create cooperative relationships with other software organizations or groups for the purpose of developing and evaluating new IV&V techniques, tools, methods, standards or processes. (a)
3. Establish a culture that transfers new IV&V technologies to in-house practitioners. (b)
4. Build outside relationships to foster external technology transfer. (b)
5. Participate in appropriate conferences, publications, and/or standards committees. (c)
6. Seek awards and recognition opportunities for IV&V teams and processes. (c)

Goal C:

Be internationally acknowledged for leading and conducting research that directly contributes to higher software assurance and improved IV&V practices.

Rationale/Background

The NASA IV&V organization must continue to advance in the area of applied research in software assurance. Developing a strong research program linked to IV&V will be paramount in the overall implementation plan. Increasing research funding and projects will be important.

Research in the areas of software assurance technologies, and systems and software engineering form a backbone for the advancement of software technologies across the agency. A key requirement of this research is to keep the IV&V practices current and, therefore, competitive. The software assurance research is also aimed at developing on behalf of the Safety & Mission Assurance organizations, the tools necessary to perform their tasks.

Objectives

- a. Research addresses validated NASA software assurance and IV&V Facility needs for both current challenges and anticipated future changes.
- b. The appropriate blend of basic and applied research is maintained.
- c. Research is accepted in leading peer reviewed journals and conferences.
- d. Research has a clear path to technology transition.
- e. Research is externally valid beyond the environment in which it was conducted.
- f. Research results are communicated to the Facility, the Agency and the public as appropriate.

Strategies

1. Research is applied to pilot projects as a proof of concept. (a,d)
2. Provide, as appropriate, local contractors and universities the opportunity to participate in IV&V related research. (a)
3. Develop repeatable processes for identifying research needs and for transitioning research results into practice at the Facility and throughout the Agency. (a,d,e)
4. Streamline research management processes to facilitate greater involvement with the researchers. (a,b,c,d,e,f)
5. Within the research group, maintain awareness of the state of the art of software assurance. (c)
6. Seek sustainable funding for IV&V Facility research. (a,b)
7. Continually assess and improve our dissemination of research results. (f)

Goal D:

Establish an organizational culture that engages and rewards employees and cultivates their loyalty and commitment to the NASA IV&V organization.

Rationale/Background

Accomplishing *every* goal of the NASA IV&V organization is made possible by the retention and/or recruitment of a qualified and dedicated work force. Employees must be encouraged and enabled to embrace professional development by participating in training opportunities in groups and individually. Opportunities to conduct innovative research and to participate in the improvement of processes and practices should be considered essential to a learning and knowledge-sharing culture. The organization is committed to strengthening adherence to the Facility's guiding values. Individuals and teams must be acknowledged and rewarded for their achievements and contributions to the success of NASA's IV&V Facility.

Objectives

- a. A working environment where employees have the opportunity for professional and personal growth exists.
- b. A diverse, unified team is motivated to accomplish the Facility's mission.
- c. Employees are recognized and rewarded based on performance and contribution to the Facility.
- d. The IV&V Facility organization embraces and practices the values established by the Facility.

Strategies

1. Allocate time to research and develop innovative improvements to processes and practices. (a)
2. Establish a skill progression profile for the Facility staff. (a)
3. Establish a training program for professional and personal growth. (a,b)
4. Share capabilities and knowledge within the IV&V Facility team. (b)
5. Establish and communicate expectations, responsibilities, and authority. (b,d)
6. Maintain an effective, open employee recognition system. (c)
7. Celebrate both professional and personal successes. (c)
8. Establish a process to communicate and evaluate both individual and organizational practice of the Facility's values. (d)

Goal E:

Ensure a continued focus on external and internal customer service that is second to none.

Rationale/Background

The NASA IV&V organization has adopted a customer commitment that states its desire to put the customer first and foremost. True customer focus starts with customer identification then continues with understanding the customer's requirements and ensuring the customer is satisfied as to how the requirements are being met. From business processes that support projects to project management, there are a myriad of ways customer focus can exceed expectations or result in failure. Incorporating customer feedback promotes continuous improvement within the Facility.

Objectives

- a. A customer 'first and foremost' way within the NASA IV&V culture exists.
- b. A high level of effective interaction with customers is demonstrated.
- c. High customer satisfaction is achieved for both external and internal customers.

Strategies

- 1. Fully implement a formal plan that solicits and receives feedback from all customers. (a,b)
- 2. Report all customer feedback, learn from it, and implement positive changes. (a,b)
- 3. Maintain regular contact with customers via telephone, email, face-to-face meetings, etc. (b)
- 4. Develop and apply an internal customer-focused training for the IV&V staff. (a,b,c)
- 5. Develop and apply training focused on raising customer awareness and understanding of the IV&V Program. (a,b,c)
- 6. Identify all NASA IV&V customers and stakeholders, and then define the specific customer and stakeholder requirements for those identified. (a,b,c)

Goal F:

Practice continuous quality improvement, compliance and innovation throughout the NASA IV&V Facility.

Rationale/Background

The NASA IV&V Facility organization continues to embrace and reward innovation and creativity by improving its organization culture, which enhances quality improvement and operational processes. With limited resources and heavy workloads, ensuring effective and efficient operations is critical. NASA IV&V organization is committed to remain compliant and certified in ISO 9000.3 practices and standards. These compliance based systems can be helpful to NASA IV&V in assessing the quality of its operations and ultimately making improvements were needed.

Objectives

- a. A culture of continuous quality improvement exists throughout the IV&V Facility.
- b. The IV&V Management System is compliant with NPD 1280.1 and the ISO standard.
- c. Innovation and creativity in improving the quality of Services, Research, Outreach, and the Foundation functional areas are supported and rewarded.

Strategies

1. Provide and support opportunities for formal and informal cross-functional discussion of opportunities for improvement. (a,c)
2. Establish a Facility-wide system for submission and review of improvement ideas. (a,c)
3. Maintain a trained ISO audit staff across all functional areas of the IV&V Facility. (b)
4. Become NPD 1280.1 compliant by developing/implementing procedures that document all functional areas within the IV&V Facility. (b)
5. Encourage and reward innovative and creative efforts in improving quality in any area of the Facility. (c)

Goal G:

Advance the NASA IV&V facility's IV&V vision and mission by managing the use of existing resources, collaborating with others and planning future growth.

Rationale/Background

The NASA IV&V organization continues to explore how best to maximize existing resources, such as its facility and organizational capabilities in Fairmont, WV. The NASA IV&V organization is often asked to partner with other organizations involved directly in a software initiative or some aspect of technology. Located in an area designated as the I-79 Technology Corridor, the NASA IV&V organization has many opportunities to work with other technology-based organizations.

NASA has stated in its vision and mission development process that activities will be fully integrated across the Agency.

Objectives

- a. The long-term growth of the NASA IV&V organization is continuously pursued.
- b. Effective collaborative opportunities that advance the NASA IV&V organization's vision and mission are sought and evaluated.
- c. The Facility's customer base within NASA and other government agencies is expanded.
- d. Existing resources in the Facility are used productively.

Strategies

1. Identify and secure necessary resources to pursue growth. (a,d)
2. Pursue growth paths as resources are available (controlled growth). (a)
3. Develop a plan to become involved with simulation certifications and build more generic in-house simulation and test bed support. (a)
4. Identify and prioritize target growth paths. (a)
5. Develop awareness and educational materials that provide background on the NASA IV&V organization's capabilities related to being a federal resource. (b,c)
6. Seek opportunities to learn and catalog the need for IV&V and related software and systems assurance in federal, state, and local government settings. (b,c)
7. Provide IV&V support to at least two non-NASA projects within the next five years. (a,c)
8. Work with the new NASA Engineering and Safety Center (NESC) to define the best partnership that separates customer relationships with programs to allow both organizations to achieve their charter requirements and assist the programs. (b,c)

9. Develop relationships and partnerships with other federal and state organizations conducting critical software development. (b,c)
10. Raise awareness of NASA IV&V, its capabilities and successes among other federal and state organizations. (b,c)
11. Design processes that evaluate how productive the allocations of existing resources are within the Facility and its work. (d)

Goal H:

Be an active community partner through outreach, educational activities, and proactive service.

Rationale/Background

The NASA IV&V Facility desires to be fully engaged in the community in which it serves. Although NASA IV&V is already receiving high marks in its educational outreach, there is a general lack of awareness or presence in most other aspects of community involvement.

From economic development focus to community outreach, NASA IV&V should have some presence. Outreach activities encompass communications and media, education, and public service. NASA IV&V through its own activities and those of its local contractors are contributing to the economic success as well as in the special relationship it has with the West Virginia community. NASA IV&V is committed to serve the community in which it lives.

Objectives

- a. Awareness of NASA IV&V, its mission and impact through organizational outreach and service activities exists.
- b. Resources and/or training opportunities related to science, math, and technology for pre-service teachers, in-service teachers, and students which will have a significant impact in the classroom are regularly provided.
- c. Resources and opportunities for students that encourage the proliferation of careers in science, technology, engineering, and mathematics are offered.

Strategies

1. Extend IV&V mission through individual and organizational presentations to and involvement in service organizations and academic institutions. (a)
2. Undertake initiatives that improve student outcomes in both science and math. (c)
3. Establish linkage and collaborate with local, state, and federal agencies in the community (e.g., sharing information, resources such as training). (a,b,c)
4. Collaborate with businesses and organizations that are most aligned with the work of the NASA IV&V organization and its goals. (a,b,c)
5. Effectively communicate NASA IV&V mission through publications, events and media.(a,b,c)
6. Participate in workforce development efforts (e.g., job fairs, local community efforts to attract NASA needed businesses, curriculum development for workforce education). (a,c)
7. Support the Student Outreach Program and the Educator Resource Center (ERC). (b,c)

Goal I:

Ensure a safe, comfortable, and well-equipped workplace that is conducive to high performance and supports individual and team productivity.

Rationale/Background

The NASA IV&V organization has been noted for its excellent facilities and work environment. A major contributor to retaining our current employees, allowing them to perform at their highest level, and to attract future employees is to provide a safe, comfortable and well-equipped workplace for all employees. Furthermore, customers who see effective and pleasing workplaces can gain a positive sense of the workforce's ability to adequately provide products and services; we want to present a sense of excellence.

Objectives

- a. The Facility's infrastructure supports all other goals and objectives.
- b. All aspects regarding safety and security are monitored and addressed when improvement or compliance is needed.
- c. The NASA IV&V Facility accommodates co-location of the IV&V staff and local contractors.

Strategies

- 1. Maintain the quality and safety of the physical conditions (e.g., building, equipment). (a,b)
- 2. Be a 'state-of-the-art' place to work in terms of the facility and equipment. (a)
- 3. Ensure adequate space is provided through the expansion of facilities. (c)
- 4. Monitor Federal, State, Agency, and local health, safety, and environmental standards and requirements to ensure compliance. (a,b)
- 5. Participate in the evolution of the Facility's business goals and objectives to ensure the Facility's infrastructure supports the modifications. (a,b,c)
- 6. Maintain a futuristic capital plan for infrastructure maintenance, modification, growth or replacement. (a,b,c)

Plan Implementation

The following are considered vital additional steps for the NASA IV&V organization's planning process to be fully successful.

Action Plan

The NASA IV&V Implementation Plan Cabinet has been established to assist in the implementation of the plan. This special cross-functional team works with a specific focus on developing the priority action plan process, authoring actions and monitoring outcomes. Through formal tracking and update procedures, the Cabinet meets on a regular basis to determine the status of all actions and address ways to assist where priority actions are not on track. The "protocol" guidelines for creating and monitoring Implementation Plan actions can be found under a separate cover.

The most current version of the action plan is stored, including archived versions, in a central file location for access and use by the Cabinet members. The detailed action plan file is the data that is monitored and updated as work is completed, as the status of action items change, or as new actions become necessary based on emerging requirements or opportunities.

Appendix B contains a copy of the charter (purpose and roles) of the NASA IV&V Implementation Plan Cabinet.

Communication Plan

The NASA IV&V organization's leadership, working with the Implementation Plan Cabinet, establishes the most effective ways to communicate the overall plan, as well as, progress on plan implementation. The communication process is designed to fully integrate the vision, mission, and values into NASA IV&V's work and existing communication vehicles (e.g., the website, annual progress reports, facility presentations, copies of the Implementation Plan).

As a strategy, information from the implementation of the Plan will be incorporated into the organization's external communication and work activities.

Appendix A

Background to the 2004-2005 Implementation Plan Review

The following information served as background reference material that was used by the assigned planning team charged with reviewing the plan and adjusting the plan as warranted. This information also contains the foundation for the objectives and strategies that are outlined in the updated plan.

Planning Activities

Starting in November 2004, a special planning team was established that consisted of the current champions of the nine goals, the Implementation Cabinet, Director Keeler and two IV&V staff members selected at large. This group helped guide the Implementation Plan review and update work. This included designing internal and external online assessment surveys, reviewing changes in the NASA organization, and studying emerging trends that will or could influence NASA IV&V in different ways.

Internal assessment surveys were sent to all NASA IV&V employees asking them for individual review of the current vision, mission, values and overarching goals from the current plan. Contractors to NASA IV&V were also asked to provide insight on areas each thought important to incorporate into the Implementation Plan during the review cycle.

A special online assessment was sent regarding NASA IV&V research efforts. This went to internal staff directly involved in the use of research and to those major researchers completing research projects through NASA IV&V. These results were combined with an earlier research survey completed by NASA IV&V's research area.

Once the majority of assessments were completed and compiled, the planning team conducted a special planning session to review and make recommendations for updates to the basic Implementation Plan framework.

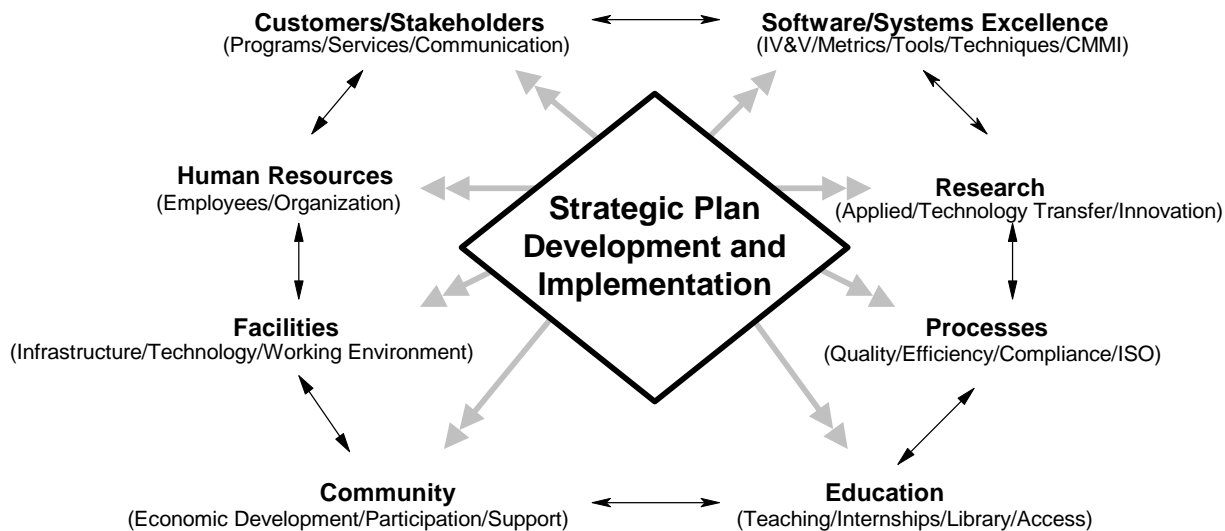
Overall Findings

For each part of the original plan (e.g., vision, mission, goals), the special planning team reviewed comments from the assessments and looked for what, if any, changes should be made. As agreed upon by those on the planning team, updates to language were made, but the general framework stayed the same, including the original nine goals. A number of lessons were learned about constructing strategies from previous planning work. These were discussed and led to significant changes in the strategies for some of the goals. Based on changes in the way NASA IV&V has done business since the plan was last updated, there were other changes necessitated in the goal, objective and strategy language in some areas of the plan. Overall, the plan remained about the same, but with more focus and clarity for the future development of actions.

Planning Focus

The diagram below reflects the planning focus areas that are the foundation of the Facility's Implementation Plan. The findings suggested there was a continued need to develop strategies across a broad range of focus areas within the organization. The diagram also shows how these major focus areas are linked (arrows) in a way that shows support. That is, while each represents a specific area, collectively they comprise the total areas NASA IV&V must focus on to be successful in reaching its vision and fulfilling its mission.

NASA IV&V Planning Focus Areas



Independent Verification and Validation

Independent (We are ensuring objective analysis.)

- Technical—IV&V prioritizes its own efforts.
- Managerial—Independent reporting route to Program Management.
- Financial—Budget is allocated by program and controlled at high level such that IV&V effectiveness is not compromised.

Verification (Are we building the product right?)

- The process of determining whether or not the products of a given phase of the software development cycle fulfill the requirements established during the previous phase.
- The process of determining if the product is internally complete, consistent, and correct enough to support next phase.

Validation (Are we building the right product?)

The process of evaluating software throughout its development process to ensure compliance with software requirements. This process ensures

- Expected behavior when subjected to anticipated events.
- No unexpected behavior when subjected to unanticipated events.
- System performs to the customer's expectations under all operational conditions.

Appendix B

NASA IV&V Implementation Plan Cabinet Charter

Purpose

As a method to implement the Implementation Plan, the original planning team determined that a permanent “Cabinet” be established both to assist in implementing and monitoring planning outcome actions and to serve as an oversight team for possible cross-functional teaming activities. The team is under the sponsorship of the NASA IV&V Director. The team will periodically review the progress of the plan actions and be responsible for chartering, as warranted, cross-functional “Action Teams” to complete specific tasks in support of the Implementation Plan.

Cabinet Membership

Each overarching goal in the Implementation Plan will have two NASA IV&V staff assigned to it as “champions” for that goal. Champions will be responsible for identifying and coordinating actions that will address strategies identified to fulfill the goal. The champions will work with the entire organization to finalize and implement actions. One of the goal champions will be considered the lead or goal subject expert. This person should be closely aligned to the assigned goal from an organizational responsibility perspective. The second champion will be from anywhere in the organization, preferably outside the subject area of the goal. This person is to work hand-in-hand with the primary champion in the action planning work. The primary champion will be assigned long term to the Cabinet, the second champion will rotate on an annual basis to ensure broader involvement by the staff in the planning process.

Each year, the membership of the Cabinet will be reviewed and rotated based on any changes in the Implementation Plan or staffing. During the year, Cabinet members will be replaced when appropriate.

Specific Roles & Responsibilities

The following are more specific expectations about the work of the members of the Cabinet.

Implementation Plan Execution

- Assist NASA IV&V leadership in developing the action plan for timely and effective implementation of the NASA IV&V Implementation Plan and for the on going planning process.
- Work as a team to set priorities on the actions to implement.
- Incorporate a strong ‘customer focus’ in all aspects of the planning process and implementation of the plan.

Monitor Performance

- Assist in developing specific performance metrics for NASA IV&V.
- Evaluate, through specific assessments, the NASA IV&V planning process and offer recommendations to leadership for appropriate adjustments to the design on a regular basis.
- Develop and support an internal “lessons learned” process for improving future planning and the capability of successfully implementing actions from the plan.

Sustain the Process

- Ensure continuous learning about the planning process across the organization by teaching, developing documentation, and coaching individuals and groups.
- Assist in establishing planning as a core competency for all NASA IV&V management positions.

- Provide organizational-wide communication of the Implementation Plan and its progress.
- Provide status reports to keep the organization informed of the implementation process and suggest ways in which staff can assist in the process to ensure its success.
- Provide feedback to the staff to let each person know how they are contributing to the success of the Implementation Plan that is being executed.
- Develop a communication plan for external dissemination about the planning and implementation for stakeholders and customers.
- Ensure the long-term incorporation of planning into the NASA IV&V culture.
- Be the keepers of the official plan and action implementation, both open actions and achievement of completed actions.
- Assist in updating the Implementation Plan on an annual basis to make sure it is relevant and that emerging issues are incorporated.

Charter Action Teams

- Provide policy guidance and resources, as needed, to deploy cross functional “action teams” to address specific implementation actions.
- Select and prioritize projects and related task team initiatives that support the overall implementation process.
- Assist in forming and empowering action teams through charter creation and membership selection.
- Ensure appropriate team accommodations and resources for the action team’s work.
- Serve as advocates for action teams to ensure that barriers are removed that hamper their efforts. This would include accepting recommendations from teams about the implementation process.
- Continually assess the best practices and lessons learned from the actual action team experiences as teams complete their work.
- Encourage the development of team-based awards and recognition opportunities.

Role Model Team

- Be a role model team that reflects a high level of collaboration and demonstrate the planning values and principles.
- Understand the basics of NASA IV&V wide initiatives, cross-cutting issues, program planning, change models and other tools & techniques related to planning both long-term strategies, as well as, short term operations.
- Be a role model as an individual team member who demonstrates and coaches the planning values and principles on behalf of NASA IV&V in your daily words and deeds.

Cabinet Member List

(A current list of cabinet members is available from NASA IV&V.)